

SENSITIVITY OF SOME CUCUMBER CULTIVARS AGAINST DOWNY MILDEW INCITED BY *Pseudoperonospora cubensis* (BERK& CURT.) ROSTOW UNDER GREENHOUSE CONDITIONS.

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ABSTRACT

In greenhouse trial all tested cucumber cultivars differed in their response to downy mildew infection. Bingo, EL-Nimir and EL-Afdal cvs. were highly susceptible by 65.1, 60.2 and 53.3% respectively, while Magdi cv. was the least susceptible one (10.4%). In addition, the least susceptible (Magdi cv.) was found superior to all other cvs. with respect to greater plant height, fresh and dry weight, the percentage of flowering (87.4%), while fruit yield average was (42.7Kg) and giving the minimum percentage of leaf infection (9.1%).

Total sugars were higher in the healthy plants of the highly susceptible cultivar than that in the least susceptible the *P. cubensis* infection decreased the total sugars in both cultivars.

Due to *P. cubensis* infection the total phenols were increased in both cultivars tested. Total phenols were higher in leaves of the least susceptible cv. than that in the highly susceptible one.

Total free amino acids content was higher in the healthy plant of the highly susceptible cv. than that of the least susceptible one *P. cubensis* infection decreased the total free amino acids in both cvs.

Both chlorophyll and carotene contents in healthy leaves of the least susceptible cv. were lower than that of the highly susceptible one. *P. cubensis* infection decreased the content of chlorophyll and carotene in both cvs.

INTRODUCTION

Downy mildew of cucumber is widely distributed all over the world and its host range includes great number of plants families and species (Spencer, 1981). The causal organism *Pseudoperonospora cubensis* (Berk & Curt.) Rostow is considered one of the most important disease of cucumber and was found to attack the Plants in the open fields and protected agricultures (Curger, 1974). Downy mildew causes severe damages to cucumber plants and often is a limiting factor in the production of watermelon and other cucurbits crops (Thomas, 1970 and El-shoraky, 1992). Bains and Sharma (1987) tested races of *P. cubensis* against 58 cultivars and lines from 7 species in 5 genera of cucurbitaceae. They found that cultivars or lines from different crops exhibited resistance specific to 1 or more races. Cohen (1976a) found that, out of 14 cucumber varieties and lines the tow vars. Poinsett and Chipper were resistant to *P. cubensis* the host response was the same in seedling and adult stages. He used colour, size, number and sporangial yield of lesions, as criteria for determination of resistance.

Cohen, (1976 b) and Narendera et al. (1978) reported that, resistance to *P. cubensis* was assessed in 23 cucumber varieties. The

American varieties were resistance. Low rate of infection and small amount of sporulation were found on them. Mahrous *et al* (1985) stated that among different cultivars of cucumber tested, the newly introduced Medina and Sweet crunch hybrids were resistance to downy mildew. On contrary the commercially grown Beit Alpha cultivar was highly susceptible.

Tahvonen (1985) stated that, an out break of downy mildew on cucumber caused by *P. cubensis* occurred in August and September 1985 in greenhouse the epidemic started simultaneously in all areas affected with isolates occurrence in other regions.

Jindal *et al* (1979) stated that, the chemical analysis of inoculated and non-inoculated plants of resistant and susceptible muskmelon showed more soluble sugars in the resistant and susceptible variety.

EL-Shanawani *et al* (1990) stated that, the highly susceptible variety of cucumber contained higher amounts of total free amino acids in healthy leaves than the highly resistant one, but *S. fuliginea* infection increased total free amino acids in both varieties. The increase in the total free amino acids was more pronounced in the highly susceptible variety than in the highly resistant one. Beihn *et al.* (1968) revealed the accumulation of phenols in resistant plant-fungi interactions and concluded that, the increase in rate of phenol synthesis occurring in response to fungal inoculation was a result of an alternation of plant metabolism similar to that occurring by mechanical injury.

Wood (1967) found that, infection caused by obligate parasites was often accompanied by striking changes in the amount and distribution of photosynthetic pigments. Loss of such pigments occurs in most diseases, oftenly on early stage. A part of the fall in photosynthesis probably depends on the losses of chlorophyll.

The objective of this study was to investigate the varietal resistance of cucumber to downy mildew under greenhouse conditions. Due consideration was given to the chemical analysis of cucumber plants.

MATERIALS AND METHODS

Varietal reaction:

Eight cucumber cultivars namely, Magdi, Basender, Shoruk, Hisham, Naser, AL-afdal, EL-Nimir and Bingo obtained from Horticulture Research Institute were used in this study. The experiments were carried out under greenhouse conditions during two seasons 1998 and 1999. At Nubariyah seeds of cucumber cultivars were sown in rows of 7m length and 1m width. Each row had 28 plants. Five replicates (plots) were prepared for each treatment. Cultural practices were followed as usual. The severity of infection was assessed weekly starting from symptoms appearance till the end of the growing period. Also, plant height, dry and fresh weight. In addition, the percent of infection leaves, flowering and the yield were also recorded.

Disease assessment

The severity of downy mildew infection was determined by using an improved grading system for measuring plant disease described by Horsfall and Barratt (1945). All the tested cucumbers were evaluated for their resistance or susceptibility against *P. cubensis* using a modified scale according to Kremer and Unterstahofer, (1967).

Chemical analysis:

Healthy and mildewed leaves of the least and highly susceptible cultivars were picked up after two months from sowing. Extractions were obtained individually using Soxhelt apparatus in 75% ethanol for 6-8 hours.

Sugars content were determined colourimetrically with picric acid methods as described by Thomas and Dutcher, (1924).

Phenols content were determined by using colourimetric methods of Folin and Denis as described by Snell and Snell, (1953).

Total free amino acids were determined colourimetrically according to the buffer acetate methods described by Rosen, (1957).

Chlorophyll and Carotene contents were determined in the acetone extract using Carl-Zeiss Spectrocolourimeter at wavelength 662, 645 and 440 nm. Chlorophyll A, B and Carotene were calculated as mg/g dry weight of leaf plade according to Wettestone (1957).

RESULTS AND DISCUSSION

Response of different cucumber to *P. cubensis*:

Data presented in Table (1) indicate that, all the tested cucumber cultivars differed in their response to downy mildew infection. Bingo cv. showed the highest percentage of infection (65.1%), while the lowest infection was observed on Magdi cv. (10.4%). The difference between the two cultivars was highly significant, but the other tested cultivars showed intermediate degree of susceptibility to downy mildew. These results are in accordance with those obtained by Cohen (1976b), Narendera *et al* (1978).

Table (1): Response of some cucumber varieties to downy mildew incited by *P. cubensis* under greenhouse conditions.

Varieties	Severity of infection (%)	Mildew response
Magdi	10.4	LS
Basender	14.2	MS
Shoruk	25.1	MS
Hisham	42.3	S
Naser	45.4	S
EL-Afdal	53.3	HS
EL-Nimir	60.2	HS
Bingo	65.1	HS
L.S.D. at 5%	5.10	-----

LS =Least susceptible
S =Susceptible

MR= Moderately susceptible
HS= Highly susceptible

Mcferson and Pike, (1979) stated that, inheritance of resistance to cucumber downy mildew was shown to be polygenic and resistance mechanisms restricted both colonization and sporulation by the pathogen and EL-korachy (1991) and EL-zayat *et al.* (1993) pointed out that, variation in the percentage of disease intensity in cucurbits under plastic house, tunnels and open field might be due to the change in environmental conditions. Breeding for resistance is the most reliable method for controlling plant diseases.

Results shown in Table (2) indicate that, all cucumber cultivars tested differed in their plant growth. Magdi cv was found superior with respect to great plant height (173.8 cm), fresh (215.9 gm) and dry weight (53.9 gm), while, Bingo cv. was the minimum of cultivars in plant height (137.5 cm), fresh (147.5 gm) and dry weight (36.9 gm). These results might be due to correlation between cucumber cultivars sensitivity to downy mildew infection and the plant characteries.

The results presented in Table (3) show that, effect of downy mildew infection on the percentage of infection leaves, flowering and the yield of the tested cucumber cultivars. Whereas, found that Magdi cv. was the minimum percentage of infection leaves (9.1%) and the maximum percentage of flowering (87.4 %) and it gave the highest fruit yield (42.7 kg/plot) while,

Table (2): Effect of downy mildew *P. cubensis* on plant height (cm), fresh and dry weight (gm) of some cucumber cultivars under greenhouse condition.

Varieties	Plant height (cm)	Fresh weight (gm)	Dry weight (gm)
Magdi	173.8	215.7	53.9
Basender	169.5	205.6	52.2
Shoruk	160.8	198.9	49.7
Hisham	152.5	183.5	45.9
Naser	150.8	178.6	44.7
EL-Afdal	146.5	161.2	40.3
EL-Nimir	139.5	152.4	38.1
Bingo	137.5	147.5	36.9
L.S.D. at 5%	8.58	14.66	6.78

Table (3):Effect of downy mildew incited by *P. cubensis* on the percentage of leaf infection , flowering and fruit yield (Kg) of some cucumber cultivars under greenhouse conditions.

Varieties	Infection leaves (%)	Flowering (%)	Yield (Kg/plot)
Magdi	9.1	87.4	42.7
Basender	12.3	82.6	39.3
Shoruk	25.2	78.3	37.1
Hisham	31.4	71.8	33.6
Naser	32.6	69.4	32.9
EL-Afdal	52.4	63.6	29.4
EL-Nimir	53.3	60.8	27.8
Bingo	61.3	55.4	24.2
L.S.D. at 5%	17.09		

Bingo cv. gave the maximum percentage of infection leaves (61.3 %) the minimum percentage of flowering (55.4%) and the lowest fruit yield (24.2 kg/plot). The other tested cultivars fall in between. These results are in agreement with those obtained by EL-Helaly *et al.* (1963) and Thomas (1970) who reported that, downy mildew of watermelon and other cucurbits is an important disease and often is a limiting factor in the production of these crops.

Data presented in Table (4) indicate that, total sugars and free amino acids were higher in the healthy plants of the highly susceptible cultivars than that in the least susceptible one. Due to *P. cubensis* infection the total sugars and free amino acids decreased in both cultivars. These results are in accordance with those obtained by Jindal *et al.* (1979) and EL-Shanawani *et al.* (1990), who reported that, the infection increased total sugars and total free amino acids in both varieties, the increase in the total sugars and total free amino acids was more pronounced in the highly susceptible variety than that in the highly resistant one. Total phenols were higher in leaves of the least susceptible cv. than that in the highly susceptible one. Due to *P. cubensis* infection total phenols increased in both cultivars but the increase was more pronounced in the highly susceptible cv. (Table 4).

Table (4): Effect of *P. cubensis* infection on total Sugars, Phenols and free amino acids in both the two cultivars Magdi (Ls) and Bingo (Hs).

Sugar and Phenol content	Magdi (LS)		Bingo (HS)	
	Healthy	Infected	Healthy	Infected
Total sugars*	17.5	16.4	24.6	22.3
Total Phenols**	27.2	28.3	17.8	21.6
Total free amino acids***	2.89	3.76	3.12	5.65

* expressed as mg glucose per gm dry weight

** expressed as mg gallicol per gm dry weight

*** expressed as mg per gm dry weight

Table (5): Effect of *P. cubensis* infection on chlorophyll and carotene contents in both cultivars leaves of Magdi (LS) and Bingo (HS) [as mg/gm dry weight].

Chlorophyll and Carotene content	Magdi (LS)		Bingo (HS)	
	Healthy	Infected	Healthy	Infected
Chlorophyll (a)	3.7	3.5	4.3	3.6
Chlorophyll (b)	2.0	2.1	2.4	2.0
Total (a) + (b)	5.7	5.6	6.7	5.6
Carotene	2.1	2.0	2.6	2.2

Similar results have also been reported by Beihn *et al.* (1968), Helal *et al.* (1978) and Abdel-Sattar *et al.* (1985), who found that, in many cases a correlation may exist between the degree of resistance and phenols levels in healthy tissues.

Data in Table (5), indicate that, in healthy plants chlorophyll (a and b) was lower in the least susceptible cultivar than in the highly susceptible one.

Due to *P. cucubensis* infection, chlorophyll (a) and (b) decreased. Downy mildew infection decreased the amount of total chlorophyll in both cultivars. Results also show that, carotene content in the least susceptible cultivars was lower than that in the most susceptible one. *P. cucubensis* infection decreased carotene content in both cultivars. Similar results were obtained by Wood (1967) and EL-Shanawani (1990), who reported that, the infection decreased the amount of total chlorophyll and carotene. Loss of such pigments occurs in most diseases caused by obligate parasites.

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حساسية بعض أصناف الخيار لمرض البياض الزغبي تحت ظروف الصوبية البلاستيكية الزراعية

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يعتبر مرض البياض الزغبي في الخيار والمتسبب عن الفطر بسيدوبرونوسورا كابينزس من الأمراض واسعة الانتشار في جمهورية مصر العربية سواء في الحقول أو تحت الصوبية البلاستيكية وقد أجرى هذا البحث لدراسة حساسية بعض أصناف الخيار للإصابة بالمرض والمحتوى الكيماوى لها

ويمكن تلخيص نتائج البحث المتحصل عليها فيما يلى :-

- 1- أظهر الصنف (مجدى) مقاومة عالية للإصابة فيما كانت الأصناف (البخور والنمر والأفضل) أكثر الأصناف قابلية للإصابة بالمرض.
- 2- وجد أن سلوك الصنف (مجدى) كان الأفضل حيث أعطى أعلى أطوال للنباتات والوزن الجاف والطرى عن الأصناف الأخرى المختبرة .
- 3- أعطى الصنف (مجدى) أعلى نسبة تزهر وزيادة محصول وأقل نسبة فى إصابة الأوراق عن باقى الأصناف الأخرى المختبرة .
- 4- كانت نسبة السكريات الذاتية والأحماض الأمينية الحرة الكلية عالية فى النباتات السليمة للصنف الأكثر قابلية للإصابة عنها فى الصنف الأقل قابلية للإصابة بينما أدت الإصابة بالبياض الزغبي الى نقص فى كمية السكريات الذاتية والأحماض الأمينية الحرة الكلية فى كلا الصنفين
- 5- كانت كمية الفينولات الكلية عالية فى الصنف الأقل قابلية للإصابة عنها فى الصنف الأكثر قابلية للإصابة . بينما أدت الإصابة بالبياض الزغبي الى زيادة كمية الفينولات الكلية فى الصنفين وكانت الزيادة واضحة فى الصنف الأكثر قابلية للإصابة
- 6- كان محتوى الأوراق من الكلوروفيل والكاروتين عاليا فى الصنف الأكثر قابلية للإصابة عنه فى الصنف الأقل قابلية للإصابة وقد أدت الإصابة الى نقص محتوى الأوراق من الكلوروفيل والكاروتين فى كلا الصنفين .